

WATER RESOURCES

GROUNDWATER

Indicator 3. Groundwater Quality

Background Groundwater is a valuable resource in Kentucky. During 1999, public water systems (those permitted to withdraw 100,000 gallons per day or more) withdrew 67 million gallons of groundwater a day to meet drinking water needs. Thousands of Kentuckians also depend on groundwater for private drinking water supplies. Since 1990, 17,620 domestic drinking water wells have been reported drilled in Kentucky. Private water wells are most numerous in eastern Kentucky and in far western Kentucky, where 65 percent of all new wells have been constructed in the state. In addition, millions of gallons of groundwater are withdrawn by businesses, industries and farmers to meet their water supply needs. Groundwater also contributes significantly to surface water flow and quality.

The Kentucky Division of Water considers groundwater quality generally good in Kentucky. However, groundwater pollution incidents have been reported in almost every county of the Commonwealth. Impacts on groundwater quality occur more frequently in the most environmentally sensitive karst areas of the state and from a range of activities including spills, leaking underground storage tanks, waste sites, agriculture runoff and untreated sewage. Groundwater contamination is often difficult, and sometimes impossible, to clean up.

Goal Safeguard from pollution the uncontaminated waters of the Commonwealth; prevent the creation of any new pollution of the waters of the Commonwealth; and abate any existing pollution per KRS 224.70-100.

Progress The Kentucky Division of Water established a statewide Ambient Groundwater Monitoring Program in 1995. The network was created to generally determine the quality of groundwater in Kentucky. To date, more than 260 wells and springs have been sampled, ranging from six times a year to one-time-only sampling. Samples are analyzed for more than 200 chemical and physical parameters including nutrients, total and dissolved metals, major inorganic ions, residues, volatile organic compounds and several pesticides, including atrazine, alachlor, metolachlor, simazine and cyanazine.

Various pesticides have been detected in springs and wells sampled in the Ambient Groundwater Monitoring Network. For example, atrazine, a commonly used herbicide in corn production, has been detected in 31 percent of springs sampled, with 1.34 percent exceeding the drinking water standard. Atrazine has also been detected in 7.4 percent of well samples, with 2.8 percent exceeding the drinking water standard.

Some of the chemicals detected in groundwater are naturally occurring. For example, fluoride is an element naturally found in water, soil, minerals, vegetation and foods. It is also found in the human body in structures such as bone and teeth. It has been shown that in communities where fluoride is naturally occurring in the water supply can make teeth stronger and more resistant to tooth decay. However, at high levels fluoride can have a detrimental effect resulting in bone disease, including pain and tenderness of the bones. The U.S. EPA has set an enforceable drinking water standard for fluoride of 4 milligram per liter. In Kentucky, less than 1 percent of the wells and springs tested had fluoride levels above the drinking water standard.

Nitrates also occur naturally through the decomposition of organic matter in soil. Nitrates and nitrites are also major constituents of

At a Glance

Withdraw of groundwater for public drinking water (1999)
.. 67 million gallons/day

Number of drinking water wells drilled in Kentucky
1990-199917,620

Number of springs and wells in groundwater monitoring network. 260

Percent of springs sampled with detects above standards
metolachlor. 5.44%
benzene 2.30%
atrazine 1.34%
nitrates 0.34%
fluoride 0.12%

Percent of wells sampled with detects above standards
nitrates. 4.30%
atrazine 2.80%
fluoride 0.90%
metolachlor 0.88%

Measure 1. Sources of Groundwater Contamination in Kentucky

Animal Feedlots
Fertilizer Applications
Landfills
Mining and Mine Drainage
Pesticide Applications
Septic Systems
Spills
Underground Storage Tanks
Urban Runoff

GROUNDWATER

| Measure 2. Ambient Groundwater Well Testing Program in Kentucky (Selected Parameters) | | | | |
|--|---------------------|-----------------------|------------------------|---------------------------------------|
| Parameter | number sites | number samples | percent detects | percent detects above HCL/MCL* |
| Alachlor | | | | |
| springs | 65 | 839 | 4.60% | 2.14% |
| wells | 110 | 451 | 1.50% | 0.66% |
| Atrazine | | | | |
| springs | 65 | 1041 | 32.70% | 1.34% |
| wells | 110 | 589 | 7.40% | 2.80% |
| Metolachlor | | | | |
| springs | 68 | 840 | 18.70% | 5.44% |
| wells | 110 | 451 | 3.30% | 0.88% |
| Nitrate-N | | | | |
| springs | 67 | 866 | 98.10% | 0.34% |
| wells | 111 | 434 | 84.70% | 4.30% |
| Arsenic** | | | | |
| public water systems | 239 | 1,249 | 7.30% | 6.2% |
| Simazine | | | | |
| springs | 64 | 885 | 4.90% | 1.24% |
| wells | 110 | 501 | 0.79% | 0 |
| Fluoride | | | | |
| springs | 68 | 820 | 99.00% | 0.12% |
| wells | 111 | 443 | 98.60% | 0.90% |
| Benzene | | | | |
| springs | 21 | 86 | 9.30% | 2.30% |
| wells | 20 | 56 | 7.14% | 0 |
| MTBE*** | | | | |
| wells & springs | 134 | 351 | 4.80% | 0 |

fertilizers and have been used for many years on croplands and lawns. Nitrates contained in fertilizers can pollute surface and groundwater. Consumption of high levels of nitrate contaminated water poses a particular health risk to infants under 6 months of age affecting the blood's ability to carry oxygen. The drinking water standard for nitrate is 10 milligrams per liter. Nitrate was detected above the drinking water standard in less than 1 percent of the springs and 4.3 percent of the wells sampled. The highest nitrate levels in Kentucky have been detected in shallow, hand-dug wells, while the lowest nitrate levels occur in deeper, drilled wells. Improper water well construction and inadequate maintenance can also make these wells more susceptible to nitrate contamination.

Water wells in the eastern and western coalfields often contain high iron, manganese and sulfur levels. Water well users commonly experience strong sulfur smells in their water, iron staining of appliances and laundry, and bacterial growth in the well. The occurrence of iron, manganese and sulfur in wells is also associated with poor water well construction and improper well maintenance.

Several measures have been undertaken to protect groundwater resources in Kentucky. These include regulations requiring facilities that have the potential to pollute groundwater to develop and implement groundwater protection plans by 2003. The Division of Water has reviewed 20 generic and 228 site specific groundwater protection plans. To date, 162 plans have been approved.

Measures - notes and sources

Measure 1. Based on best professional judgement by the Ky. Division of Water. Sources not ranked. Source: Ky. Division of Water.

Measure 2. Based on tests conducted between 1995-1999. *Detections above health advisory limit or drinking water maximum contaminant levels. **Based on an assessment of 239 public water supply wells, springs and private wells. Arsenic detects above standard is based on proposed MCL of 0.01 mg/L. ***Data not broken down by wells and springs. Source: Ky. Division of Water.